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APPENDIX 7

SYSTEM MANAGEMENT 2

FINAL SOFTWARE REPORT

DATA ITEM NO. A005

INTEGRATED ELECTRONIC WARFARE SYSTEM ADVANCED DEVELOPMENT MODEL (ADM)

PREPARED FOR:

NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PENNSYLVANIA

CONTRACT N62269-75-C-0070

RAYTHEON
ELECTROMAGNETIC
SYSTEMS DIVISION

1 OCTOBER 1977

APPENDIX 7

SYSTEM MANAGEMENT DESIGN SPECIFICATION
FINAL SOFTWARE REPORT

DATA ITEM A005

INTEGRATED ELECTRONIC WARFARE SYSTEM (IEWS)
ADVANCED DEVELOPMENT MODEL (ADM)

Contract No. N62269-75-C-0070

Prepared for:

Naval Air Development Center
Warminister, Pennsylvania

Prepared by:

RAYTHEON COMPANY
Electromagnetic Systems Division
6380 Hollister Avenue
Goleta, California 93017

1 OCTOBER 1977

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			SHEET 1 OF 24 REV

TYPE OF SPEC

TITLE OF SPEC

COMPUTER SUBPROGRAM DESIGN DOCUMENT, SYSTEM MANAGEMENT 2, IEWS

FUNCTION	APPROVED	DATE	FUNCTION	APPROVED	DATE
WRITER	Thomas L. Chernosky	14 Oct 76			

REVISIONS

CHK	DESCRIPTION	REV	CHK	DESCRIPTION	REV

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1.0 SCOPE

1.1 IDENTIFICATION

This document describes the implementation of the System Management 2 (SM2) Functional Group of the SC Operational Software resident in Resource Management Processor (RMP).

1.2 SUBPROGRAM TASKS

1.2.1 System Management 2 Driver

SMDR shall have the responsibility of decoding System Management 1 (SM1) messages passed to it from the RMP Executive. It shall then call the appropriate SM2 processing routine.

1.2.2 Overflow Message Processing

SMOFP shall process the SM1 messages resulting from Sorter Throttle Files Full and Sorter Track Files Full messages.

1.2.3 Threshold Control Processing

SMTHR and SMTHI shall process the SM1 messages resulting from Sorter IB $\geq$ 3/4 Full and IB $\leq$ 1/4 Full messages, respectively.

1.2.4 Aircraft Parameters Processing

SMACP shall process the RMP-Executive-origined request for an Aircraft Parameters update. It shall interrogate the Inertial Navigation System (INS) and distribute the INS data to the common data base and the Parameter Encoder (PE).

2.0 APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of the Computer Program Design Specification for the Integrated Electronic Warfare System (IEWS) Advanced Development Model (ADM) Program shall be considered superseding requirements.

2.1 COMPUTER PROGRAM PERFORMANCE SPECIFICATION

Computer Program Performance Specification for the Integrated Electronic Warfare System (IEWS) Advanced Development Model (ADM) Program (U), Raytheon Company, Electromagnetic Systems Division, (Number 061290529), (date 1 June 1976), (classification U).

2.1.1 Applicable CPPS Paragraphs

Module Name	CPPS Paragraph
System Management 2 Driver	Not specified explicitly
Overflow Processing	3.3.7.2
Threshold Control	3.3.7.1
Aircraft Parameters	3.3.7.3

2.2 COMPUTER PROGRAM DESIGN SPECIFICATION

Computer Program Design Specification for the Integrated Electronic Warfare System (IEWS) Advanced Development Model (ADM) Program (U), Raytheon Company, Electromagnetic Systems Division, (number 53959-GT-0750), (date TBD), (classification U).

2.3 DATA BASE DESIGN DOCUMENT

The Common Data Base Design Document, System Controller Unit, IEWS, ADM, Document No. 53959-GT-0751, shall apply to this subprogram.

2.4 MISCELLANEOUS DOCUMENTS

The following documents shall apply to this subprogram:

Document No.	Document Title
53959-GT-0756	Computer Subprogram Design Document, Executive, IEWS
53959-JK-1002	Interface Control Document, System Controller - Sorter
53959-GT-0759	Computer Subprogram Design Document, Data Extraction, IEWS
53959-NJK-0200	Unit Hardware Development Specification, Parameter Encoder, IEWS
TBD	STE Software Document
WS-8506 Revision 1, 1 November 1971	Requirements for Digital Computer Program Documentation

3.0 REQUIREMENTS

3.1 SUBPROGRAM DETAILED DESCRIPTION

3.1.1 System Management 2 Driver (SMDR)

SMDR shall be the driver routine of the SM2 Functional Group. The Exec shall pass to SMDR one of the following in the X-register:

1) The value Ø
2) A pointer to a SM1 message

If the X-register contains Ø, the Aircraft Parameters Routine (SMACP) shall be called to (1) update the common data base image of the following:

INS Variable	Common Data Base Item
Aircraft Heading	SYHDC
Altitude	SYALC
Pitch	SYPTC
Roll	SYROC

and (2) update the azimuth correction field of the SC-to-PE Interface.

If the X-register is non-zero, SMDR shall use it as a pointer to retrieve the Sorter Op-code from the SM1 message (see Figure 3). The Op-code shall be fetched from the left byte of SOS1. X'89' shall then be subtracted fromthe Op-code to compute an index, i. This index, which exists only in the A-register, shall be verified to be in the range $\emptyset \leq i \leq 3$. If i is out of range, control shall be transferred to label SMD8Ø, where an instrumentation message is sent to the EXEC. Control shall then be returned to the EXEC. If i is in the specified range, the value of i (A-register) shall be added to the address of the SM2 processing table (SM2PT) and the result stored in the B-register. The effective address

(B-register) shall be used indirectly to call one of the SM2 processing routines, whose list of symbolic names constitute SM2PT. All of the processing routines shall be passed the same data:

1) The address of the SM1 message word Ø in the X-register.
2) The contents of the right byte of the Op-code word in the A-register. (This right byte may be the SFN).

After the individual message processing routine has completed its task, control shall be returned by SMDR to the EXEC.

3.1.2 Overflow Message Processing (SMO FP)

The function of SMOFP shall be partially implemented in the priority 1 SC software. This routine is called by the driver to process SM1 messages derived from the Sorter Track Files Full and Sorter Throttle Files Full messages. In the case of Track File Overflow, the complete implementation would:

1) Search the Emiter Track File for a "deletable" emitter.
2) Send a Create File message to the Sorter (overwriting the existing Sorter Track File).
3) Process the overflow emitter as a new emitter.

Throttle File Overflow processing has not been specified explicitly in the CPPS.

In the priority 1 implementation, SMOFP shall receive from the driver a pointer to the SOMNO word of the SM1 message in the X-register (See Figure 3), and the Sorter File Number (SFN) in the A-register. The priority 1 version of SMOFP shall simply send the Sorter Overflow message data to Data Extraction (see Data Extraction CSDD). Control shall then be returned to the driver.

3.1.3 Threshold Control Processing (SMTHR)

The function of SMTHR shall be partially implemented in the priority 1 SC software. This routine shall be called by the driver to process SM1 messages derived from Sorter IB $\geq$ 3/4 Full messages (processed by SMTHR) or Sorter IB $\leq$ 1/4 Full messages (processed by SMTHI). This routine would decrement (SMTHR) or increment (SMTHI) the value of the encoding threshold and if the new value was in the specified range, it would be saved in the Common Data Base as SYTHC and the encoding threshold field in the SC-to-PE Interface would be updated. (See Parameter Encoder Unit Hardware Specification). However, in the priority 1 implementation, no data is transferred to the Common Data Base or the PE. As implemented, SMTHR (SMTHI) shall receive from the driver, a pointer to the SOMNO word of the SM1 message in the X-register (See Figure 3) and the SFN in the A-register. SMTHR (SMTHI) shall then retrieve the current value of the encoding threshold (SYTHC) from the common data base. The decremental (incremental) value (SYTHV) shall be subtracted from (added to) to the current value of the threshold. If the difference is less than the lower limit SYTHL (sum is greater than the upper limit SYTHU), processing shall continue at label SMT99. Otherwise, processing shall continue at label SMT8Ø. In the priotity 1 implementation, SMT8Ø shall simply pass control to SMT99.

3.1.3.1 SMT99

At label SMT99, control shall be returned to the SM2 driver.

3.1.4 Aircraft Parameters Processing (SMACP)

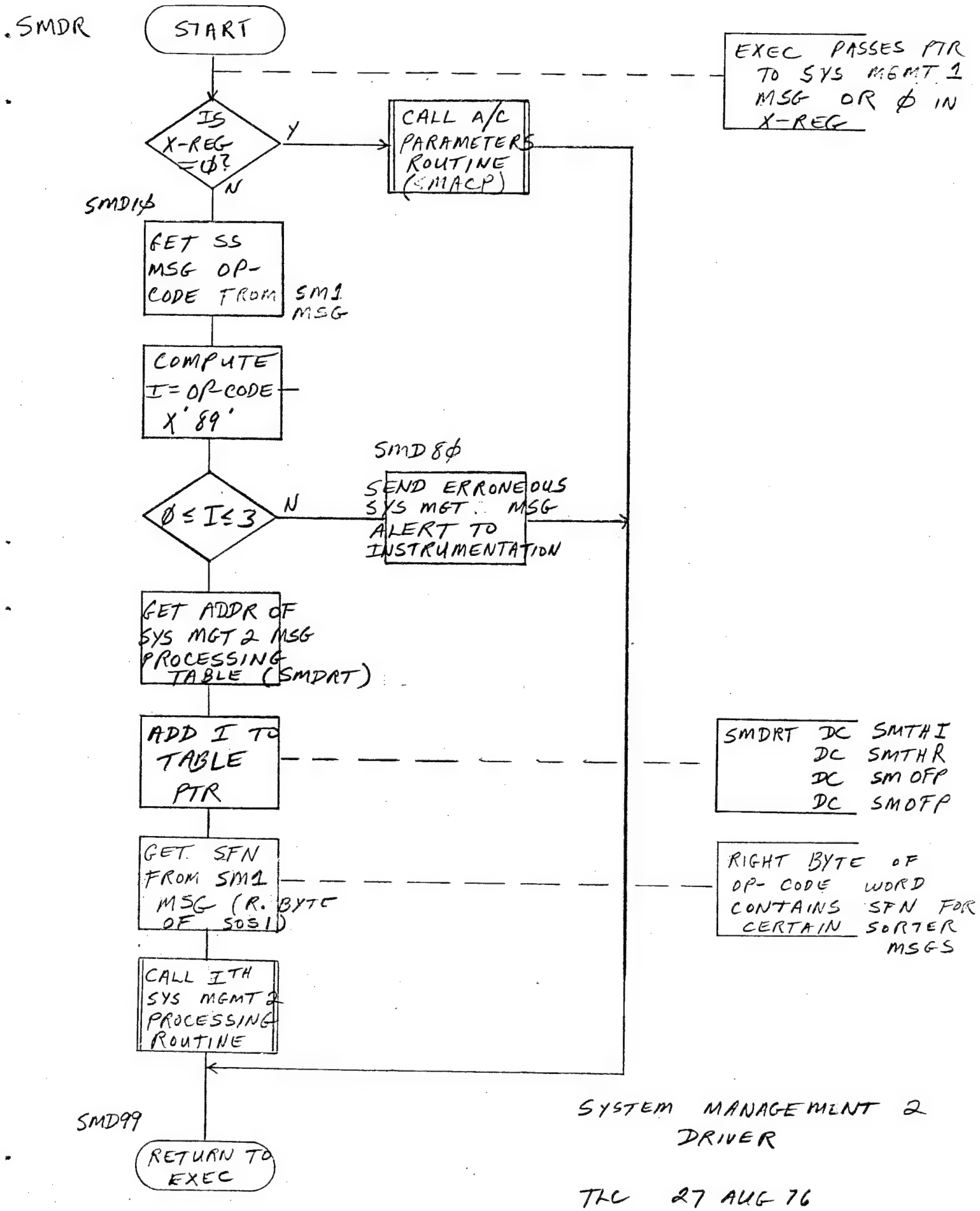
The function of SMACP shall be partially implemented in the priority 1 SC software. This routine shall be called by the driver in response to an aircraft parameter update request from the RMP. This routine shall interrogate the Inertial Navigation System (INS) to obtain the current value of aircraft heading altitude, pitch, and roll. This data shall be stored in the common data as SYHDC, SYALC, SYPTC, and

SYROC, respectively. The INS function in the priority 1 implementation shall be supplied by the STE software (See STE software document). The azimuth correction factor shall then be computed by adding the new current value of aircraft heading (SYHDC) to the antenna boresight bearing constant (SYBAC). The sum shall be stored in the common data base as SYFAC, the azimuth correction factor. Subroutine SMPEU shall than be called to update the SC-To-PE Interface (See Figure 1).

Additional processing not included in the priority 1 implementation would then be performed. This would include a check for excessive pitch or roll. If either is excessive and the Sorter NESU processor is in the active state (processing PDW's), the NESU would be placed in the inactive state (via an SC-to-Sorter message). If the value of both pitch and roll are acceptable and the NESU is not active, it would be activated (via an SC-to-Sorter message). In all cases, control shall then be returned to the SM2 driver.

3.1.4.1 SMPEU

SMPEU shall compute the value of the data word to be stored in the SC-to-PE Interface. The format of this data word is shown in Figure 1. SMPEU shall retrieve the value of the azimuth correction factor (SYFAC) from the common data base and combine it with the current value of the encoding threshold (SYTHC). This data word shall then be sent to the PE (via address X'F206'). Control is returned to the calling routine.



SYSTEM MANAGEMENT 2 DRIVER

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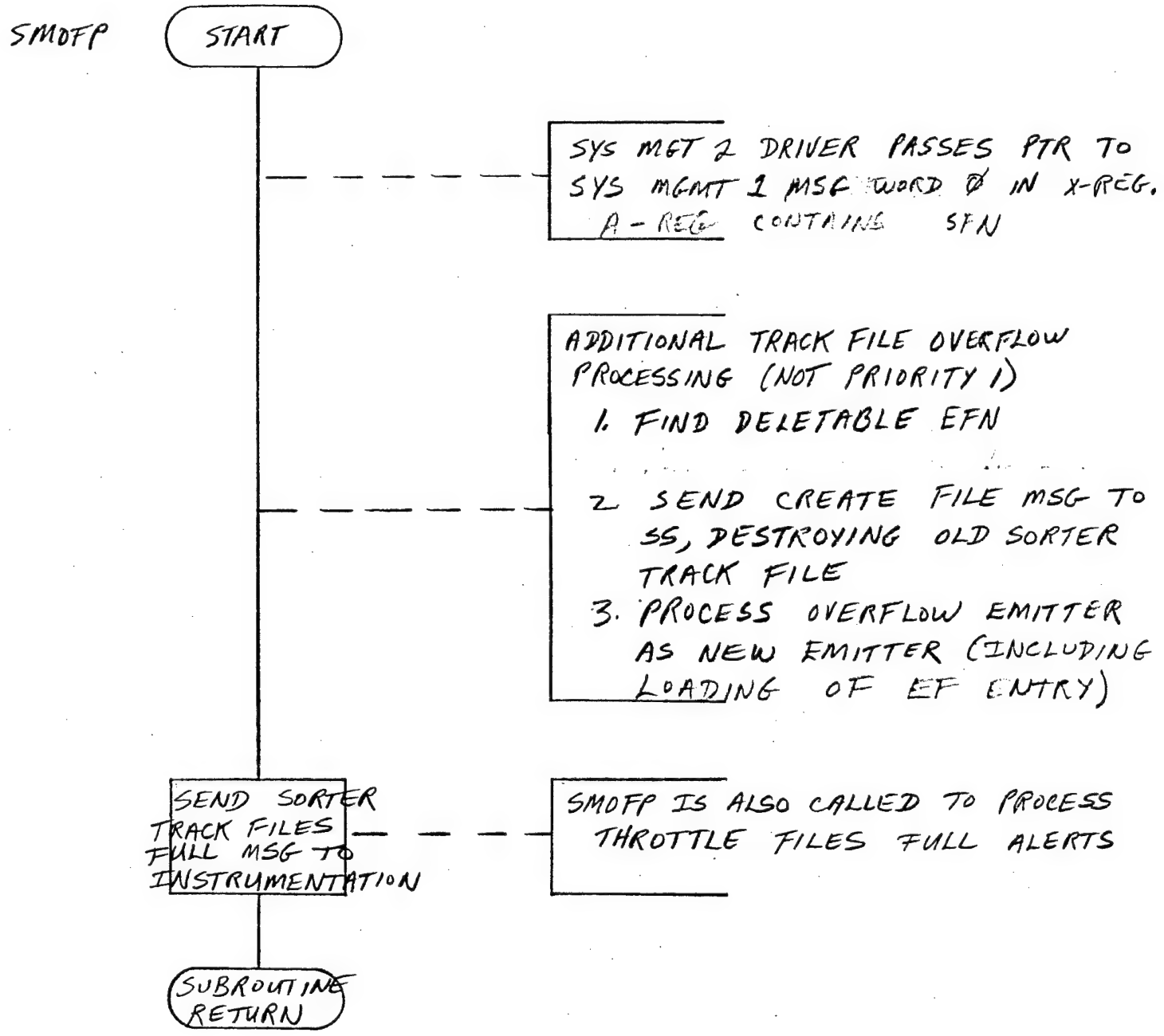

SORTER OVERFLOW PROCESSING

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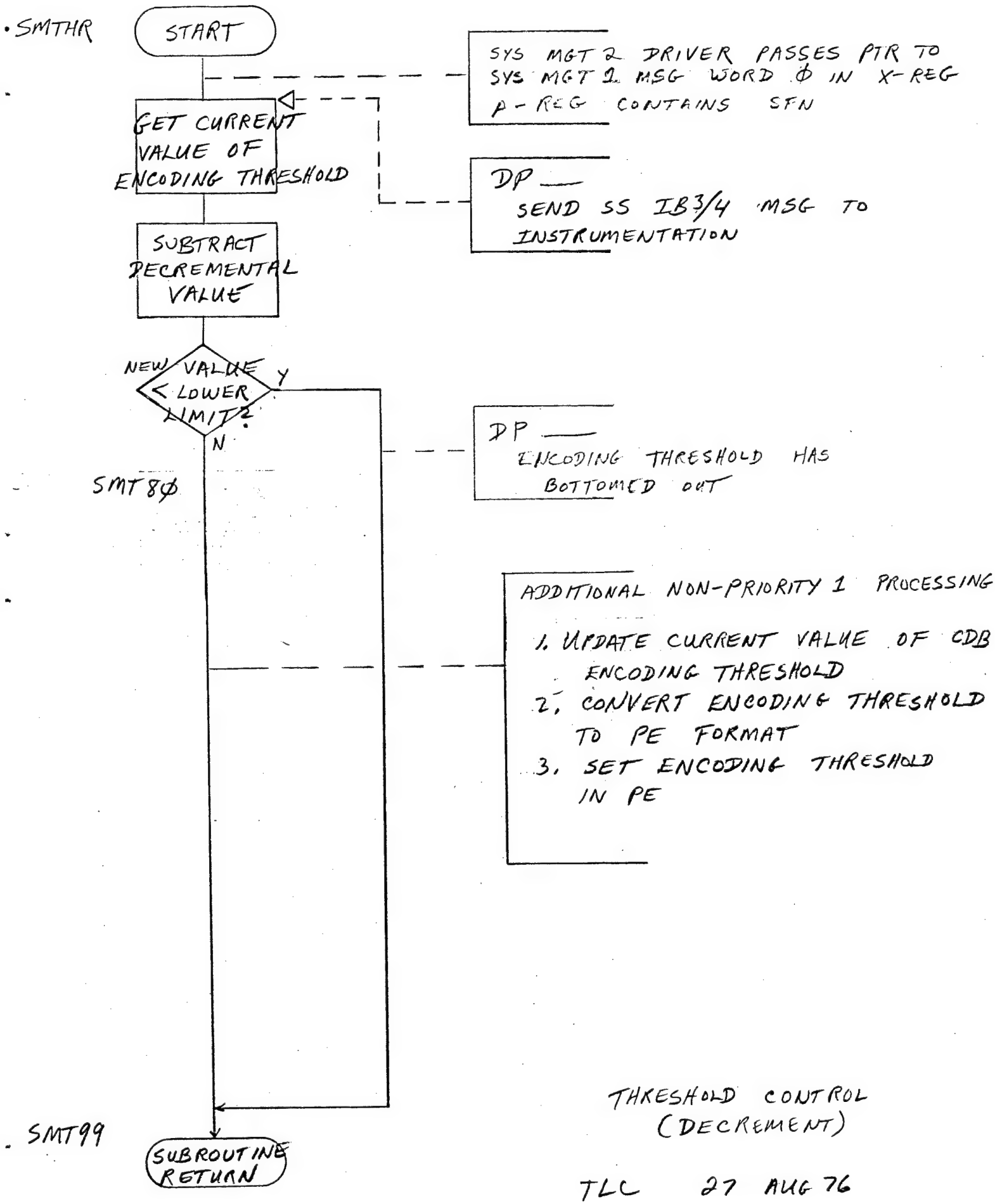

THRESHOLD CONTROL
(DECREMENT)

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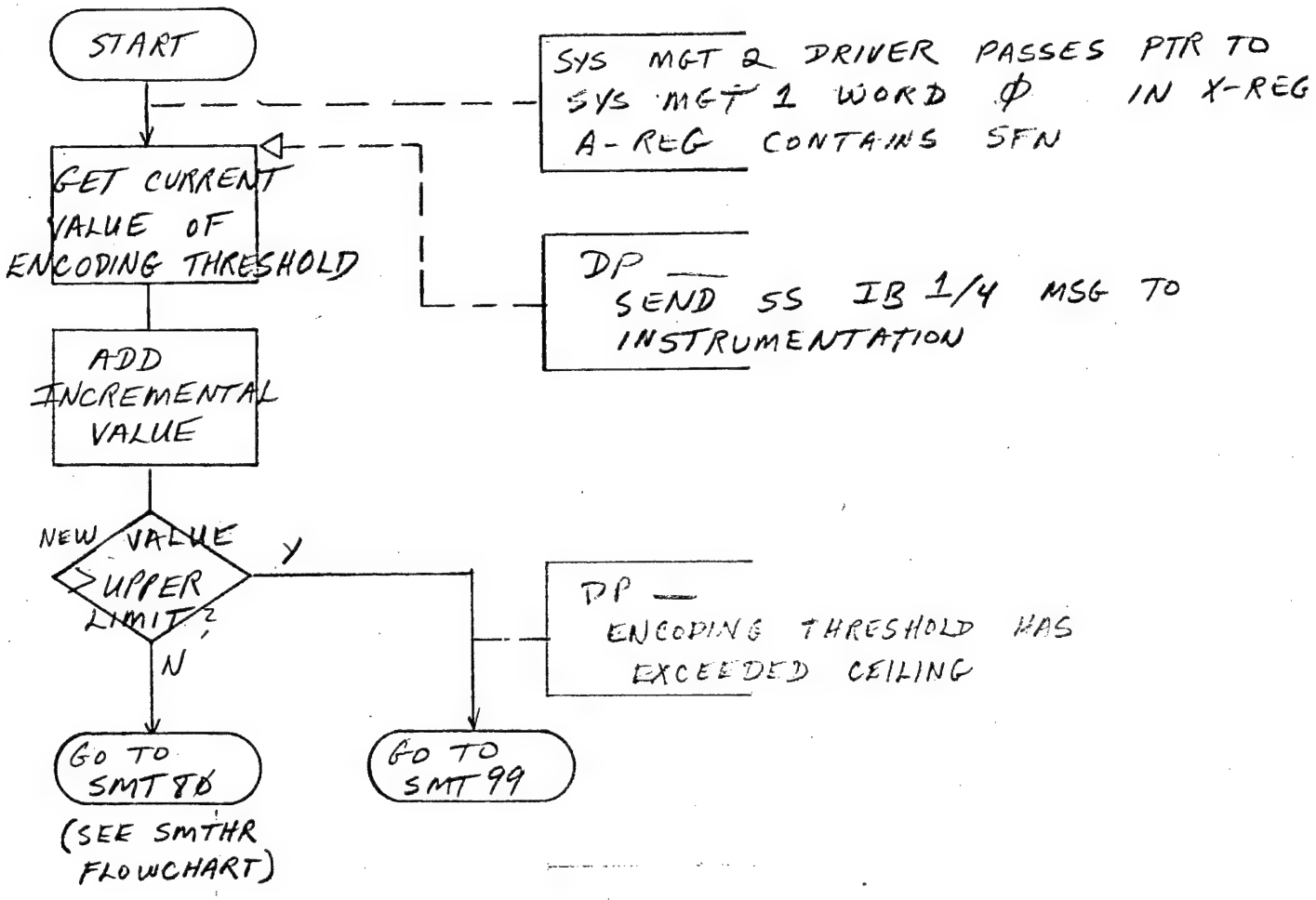
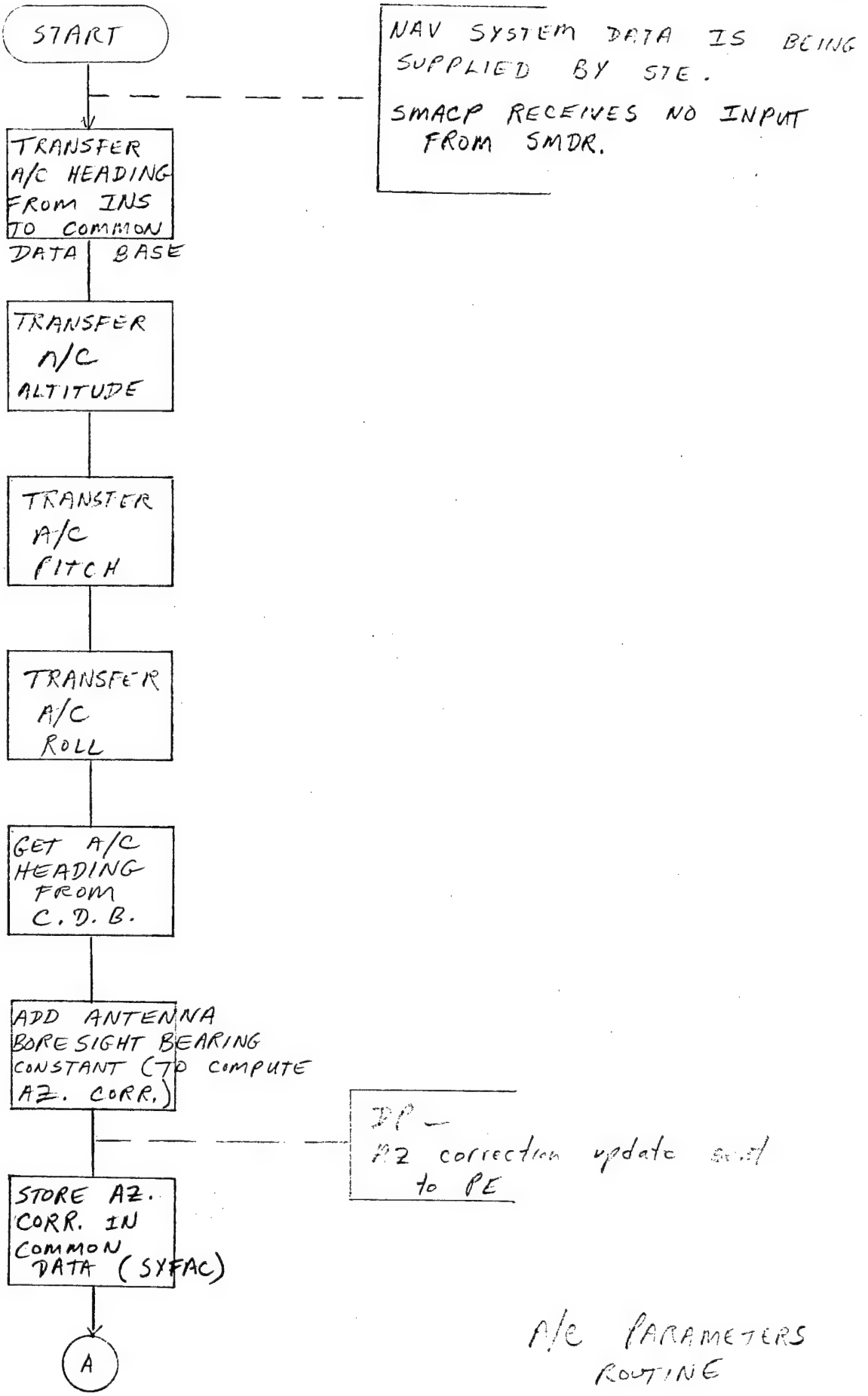
SMTHI



THRESHOLD CONTROL (INCREMENT)

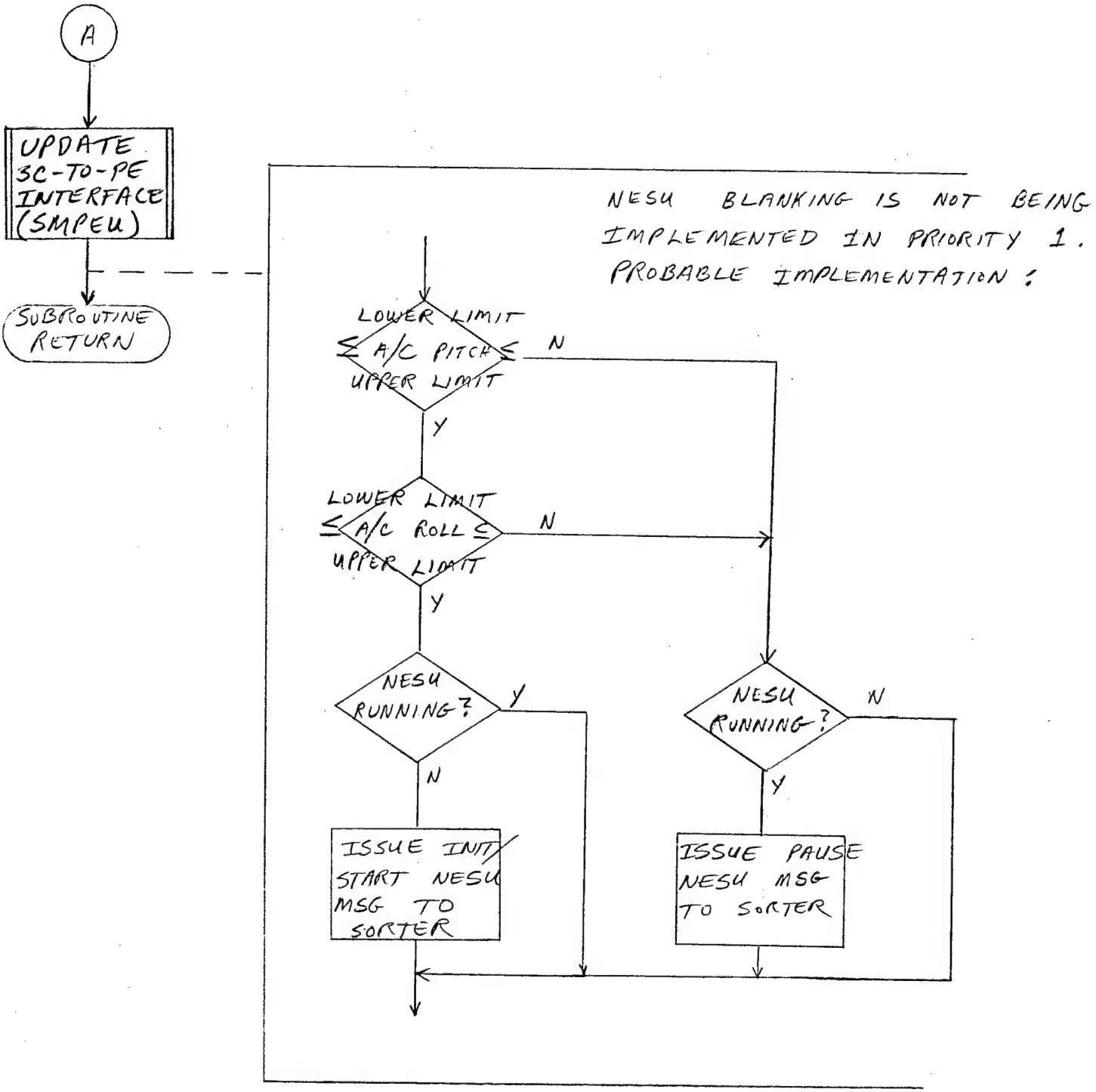
TLC 27 AUG 76

SMACP



A/C PARAMETERS ROUTINE

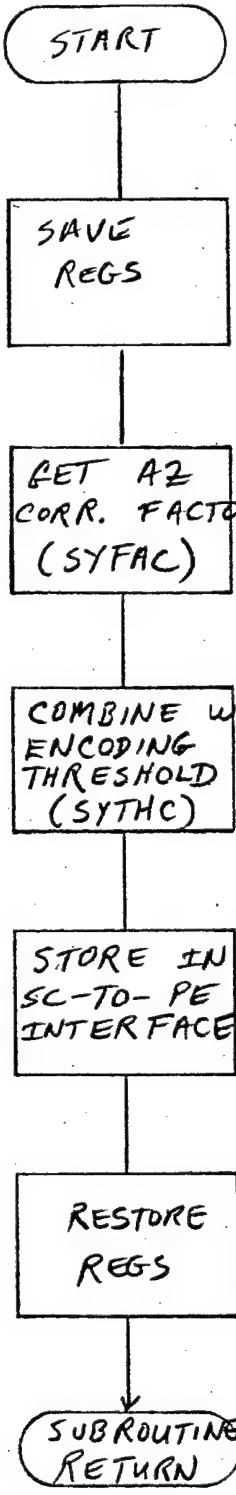
TLC 14 SEP 76



A/C PARAMETERS ROUTINE

TLC 14 SEP 76

SMPEU



LONG PULSE MODES CODE OF SC-TO PE INTERFACE SHALL ALWAYS BE B'ØØ' IN PRIORITY ↓ SC SOFTWARE.

UPDATE SC-TO-PE INTERFACE
4 OCT 76 TLC

3.3 COMPUTER SUBPROGRAM ENVIRONMENT

3.3.1 Tables

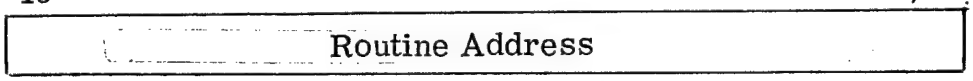
3.3.1.1 System Management 2 Driver Table

SM2 Processing Table (SM2PT)

Purpose and Type - Fixed length table containing the addresses of the subroutines called by the SM2 driver to process SM1 messages.

Size and Indexing Procedure - Four (4) entries of one (1) 16-bit word. All entries shall be referenced by indexed displacement from the start of the table.

Entry Format



Field	Description	Units	LSB
Routine Addr	Address of a SM2 processing routine	N/A	N/A

3.3.2 Variables

There shall be no local variables associated with the SM2 Functional Group.

3.3.3 Constants

There shall be no local constants associated with the SM2 Functional Group.

3.3.4 Flags

There shall be no local flags associated with the SM2 Functional Group.

3.3.5 Indices

3.3.5.1 System Management 2 Driver Indices

SM2 Processing Table Index

a. Index Name: i (not a symbolic label)

b. Purpose: This index shall be used to fetch a SM1 message processing routine address from table SM2PT.

The index shall assume the following range of values: $0 \leq i \leq 3$.

3.3.6 Common Data Base References

The following items in the common data base are referenced by the routines in the SM2 Functional Group:

CDB Symbol	Referencing Routine	Description
SYTHU	SMTHR, SMTHI	Encoding threshold upper limit
SYTHL	" "	" " lower limit
SYTHC	" "	" " current value
SYTHV	" "	" " incremental/ decremental value
SYHDC	SMACP	Current value of aircraft heading
SYALC	"	" " " altitude
SYPTC	"	" " " pitch
SYROC	"	" " " roll
SYFAC	"	" " azimuth correction factor
SYBAC	"	Antenna boresight bearing constant

3.4 INPUT/OUTPUT FORMATS

3.4.1 Input

The format of the input SM1 messages shall be as specified in the Common Data Base Design Document 53959-GT-0751 (See Figure 3).

The format of data input from the Inertial Navigation System shall be as specified in the TBD . The field definition of the INS-to-SC Interface is shown in Figure 2.

3.4.2 Output

The format of the output instrumentation data shall be as specified in the Data Extraction CSDD, .

The format of the data output to the SC-to-PE Interface shall be as specified in the Parameter Encoder Unit Hardware Development Specification. The field definition of this interface is shown in Figure 1.

3.5 SYSTEM LIBRARY SUBROUTINES

There are no system library subroutines required by the SM2 Functional Group.

3.6 CONDITIONS FOR INITIALIZATION

This subprogram shall have unconditional entry and shall require no special initialization procedure.

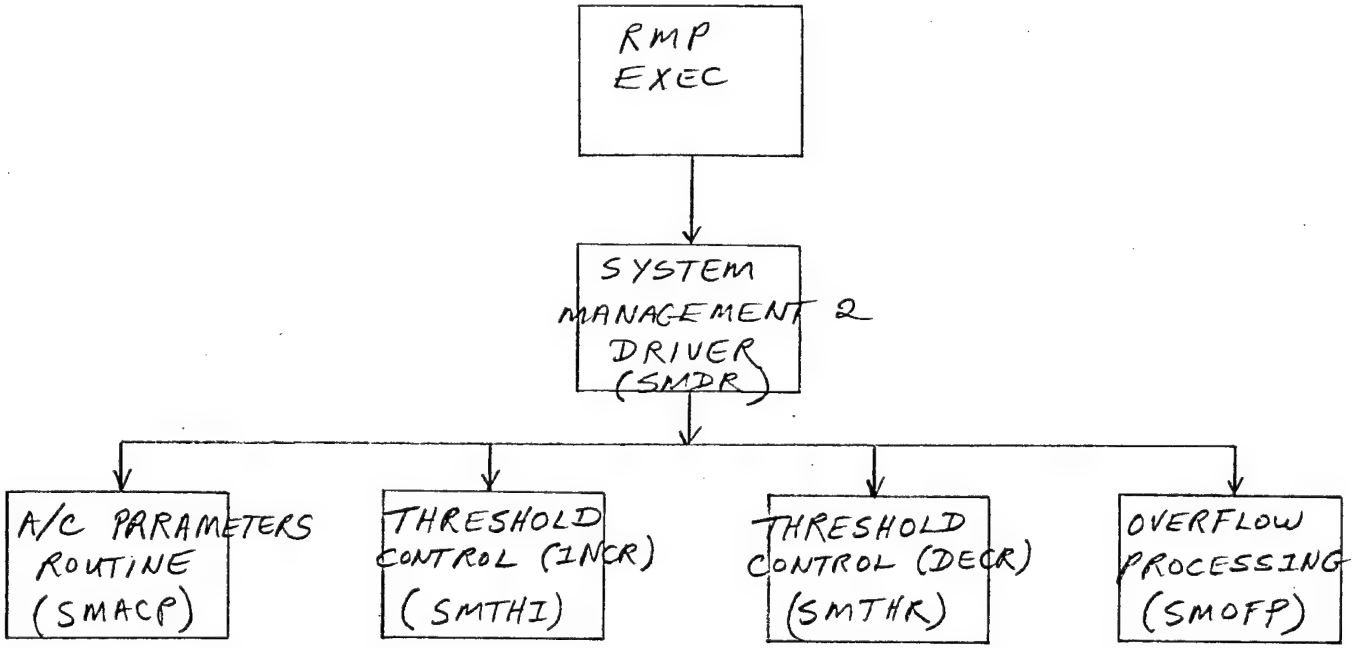
3.7 SUBPROGRAM LIMITATIONS

The SM2 Functional Group makes the following assumptions:

If SMDR is processing a SM1 message (Sorter derived), the only Sorter message Op-codes processed shall be X'89', X'8A', X'8B', and X'8C'. All others shall result in an error alert message being sent to Data Extraction.

3.8 INTERFACE DESCRIPTION

The SM2 driver shall be called by the RMP EXEC. The driver then shall then call one of the SM2 processing routines (SMACP, SMTHI, SMTHR, or SMOFP). Instrumentation shall be called as required for data extraction and is not shown on the diagrams.



INTERFACE DESCRIPTION
SYSTEM MANAGEMENT 2

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15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X	LP			THRESH				ACOR							

Field	Description	Units	LSB
LP	Long Pulse Modes	TBD	TBD
THRESH	Encoding Threshold	dB	1.6
ACOR	Angle Correction Data	Degrees, increasing CW, wrap-around at X'FF'	1.40625

Figure 1. SC-To-PE Interface

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word Ø	Ø								HDG						
1	ALT														
2	PITCH														
3	ROLL														

Field	Description	Units	LSB
HDG	Aircraft Heading	Degrees, increasing CW, wrap-around at X'FF'	1.40625
ALT	Aircraft Altitude	Feet	1ØØ
PITCH	Aircraft Pitch	TBD	TBD
ROLL	Aircraft Roll	TBD	TBD

Figure 2. INS-to-SC Interface

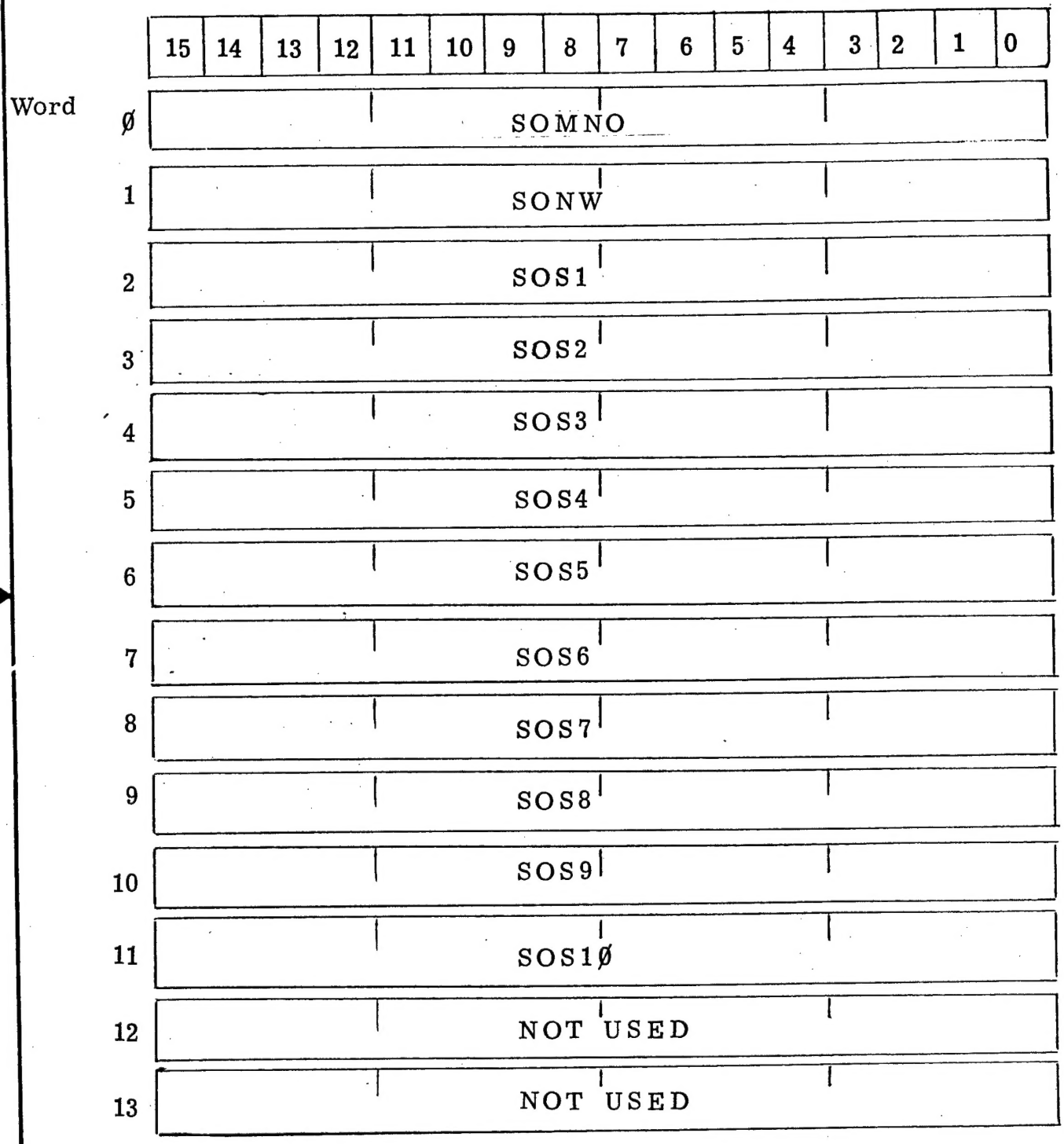

Figure 3a. System Management 1 Message (from CP)

Field	Description	Units	LSB
SOMNO	Message number (= TBD)	N/A	1
SONW	Number of words in message	N/A	1
SOS1	Sorter message word 1 (Op-Code, etc.)	"	N/A
SOS2	2	"	"
SOS3	3	"	"
SOS4	4	"	"
SOS5	5	"	"
SOS6	6	"	"
SOS7	7	"	"
SOS8	8	"	"
SOS9	9	"	"
SOS10	10	N/A	N/A

Figure 3b. System Management 1 Message (from CP)